LATCH ASSEMBLY WITH DEAD LATCH INDICATOR

This invention generally relates to latch assemblies of the kind having a key operated actuator operable from an outer side of the assembly and a further actuator operable from an inner side of the assembly the operation of the further actuator being controlled by a further key operated lock. It will be convenient to hereinafter describe the invention with particular reference to doors, however it will be appreciated that the invention is applicable to any movable member adapted to close an access opening.

Latch assemblies of the foregoing kind include a latch bolt which can be retracted to a release position by operation of at least the inner side actuator. The inner side actuator is normally a turn knob or handle which is rotated to retract the latch bolt. Rotation of the turn knob is controlled by the key operated lock to improve security. When the lock is in an inactive condition the turn knob is operable, whilst when the lock is in an active condition the turn knob is inoperable. A latch assembly having this feature is generally referred to as a dead latch.

A problem associated with dead latch assemblies is that for the user to determine whether the lock is in an active condition, they must attempt to rotate the inner actuator. When the user finds the lock is in the active condition the user is required to locate the key to deactivate the lock to operate the turn knob. This can create an inconvenience when the user needs to urgently open the door. One solution is to leave the key in the lock, however this reduces the level of security provided by the dead latch feature. It would be advantageous for the latch assembly to be adapted to facilitate conveying the condition of the lock to the user.

According to this invention there is provided a latch assembly including a casing, a latch bolt mounted on the casing for linear movement relative thereto between an extended latching position and a retracted release position, a first actuator operable from an inner side of the assembly and a second actuator being a second key operable lock being the only actuator operable from an

outer side of the assembly, the first and second actuators each being operable to retract the latch bolt to the release position, a first key operated lock operable from the inner side of the assembly operating a locking means which in an active condition renders the first actuator inoperable, each of said first and second key operated lock having a cylinder body and a barrel housed within the cylinder body being rotatably movable relative to the cylinder body by an appropriately configured key, the locking means associated with the first key operated lock having drive means being external to the cylinder body and movable in response to movement of the barrel between first and second positions at which positions the locking means is in the active or an inactive condition respectively, and indicator means responsive to the movement of the drive means providing a visual indicator visible from the inner side of the assembly that the locking means is in the active condition.

The indicator means providing a visual indicator visible from the inner side of the assembly, visually conveys the condition of the lock to the user. This allows a user to determine the condition of the lock without having to physically test the operability of the first actuator.

It is preferred that the latch assembly include lock release means which is responsive to operation of the second actuator so as to thereby render the locking means inactive. In a preferred form the drive means includes a cam member which is rotatable about an axis in response to movement of the barrel, detent means co-operable with the cam member including at least one detent member which moves substantially radially of the cam axis between an actuator locking position and an actuator release position which corresponds to the active and inactive conditions of the locking means respectively.

It is preferred that the indicator means includes a lock active indicator, the inner side of the assembly being adapted to co-operate with the lock active indicator to indicate the locking means is in the active condition. The inner side of the assembly may be adapted in any manner to indicate the condition of the locking means. In a preferred embodiment the inner side of the assembly includes a window through which window the lock active indicator is visible

when the locking means is in the active condition and not visible when the locking means is in the inactive condition. The indicator means may also include a lock inactive indicator which is visible when the locking means is inactive.

The lock active indicator may be located in any suitable position. In one preferred embodiment the lock active indicator and further preferably the lock inactive indicator is located on the cam member. In another preferred embodiment the lock active indicator and further preferably the lock inactive indicator is located on the at least one detent member. Alternatively the indicator means includes a driven member which engages the cam member being rotatable about an axis in response to movement of the cam member, the lock active indicator and preferably the lock inactive indicator being associated with the driven member to rotate with the driven member. The cam member and driven member may include a plurality of projections which interact in a gear arrangement to provide driving engagement between the cam member and the driven member. The indicator means preferably includes biasing means acting on the driven member which urges the cam member towards the second position.

Embodiments of the invention are hereinafter described in detail in the following passages of the specification which refer to the accompanying drawings. The drawings, however, are merely illustrative of how the invention might be put into effect, so that the specific form and arrangement of the various features, as shown, is not to be understood as limiting on the invention.

In the drawings

Figure 1 is a diagrammatic perspective view of a preferred embodiment of a latch assembly when installed according to this invention.

Figure 2 is an exploded view of the latch assembly showing more of the inner workings.

Figure 3 is a rear view of the latch assembly, with the second actuator removed while the locking means is in the inactive condition.

Figure 4 is a cross sectional view along line IV-IV of figure 3 showing the first actuator.

Figure 5 is a rear view of the latch assembly, with the second actuator removed while the locking means is in the active condition.

Figure 6 is a cross sectional view along line VI-VI of figure 5.

Figure 7 is a rear view of the latch assembly, with the second actuator removed while the locking means is in the inactive condition.

Figure 8 is a cross sectional view along line VIII-VIII of figure 7.

Figure 9 is an exploded view of the first actuator with the window in an alternate location.

Figure 10 is a diagrammatic perspective view of the preferred embodiment of the latch assembly from figure 9.

Figure 11 is an exploded view of the first actuator with the window in a further alternate location.

Figure 12 is a diagrammatic perspective view of the preferred embodiment of the latch assembly from figure 11.

Figure 1 shows a latch assembly 1 incorporating one embodiment of the invention. The latch assembly illustrated includes a housing 4 covering the inner workings of the latch assembly 1. A latch bolt 3 extends out to one side of the housing 4, and a first actuator 7, including a turn knob 9 is located on the front face of the housing 4. Whilst a turn knob 7 is illustrated other forms, such as a handle, may also be suitable. The housing 4 illustrated is surface mounted on one side of the door 2, normally the inner side. A second actuator 8 in the form

of a key operated lock is shown in phantom located on the other side of the door 2, normally the outer side.

The second or outer actuator 8 which is shown in figure 2may include a key operated lock 10, and in a typical arrangement that lock includes a body or cylinder 11 and a barrel 12 rotatably mounted in the cylinder 11. Tumblers (not shown), such as pin tumblers, may interact between the cylinder 11 and the barrel 12 in a known manner so as to prevent relative rotation of the barrel 12 unless a correctly cut key is inserted into a key way (not shown) of the barrel 12.

The latch bolt 3 may be biased towards an extended position. The first and second actuators 7, 8 are connected to the latch bolt 3 such that rotation of the first or second actuator 7, 8 causes retraction of the latch bolt 3 towards a release position. The first and second actuators 7, 8 can be connected to the latch bolt 3 in any appropriate manner to cause the linear movement of the bolt 3 into the retracted position.

Referring still to figure 1, the turn knob 9 illustrated includes an aperture or window 70 through which a active indicator surface 71 can be seen. The operation of an indicator means controlling the active indicator surface 71 will be discussed later in the specification, however it is relevant to note that the location of the window 70 in figure 1 is merely preferred. The window 70 may be located at another position on the turn knob 9 or even the housing 4 itself. These alternation locations for the window 70 are described later in the specification.

Referring still to figure 1, the turn knob 9 illustrated includes a key way 72 for receiving a key. The key way 72 is associated with a first key operated lock which will be discussed later in the specification. However, it is relevant to note the position of the key way 71 relative to the window 70 being such that operation of the first key operated lock by the key is unlikely to provide a visual barrier to the window 70.

Referring now to figure 2 which is exploded view of the first actuator 7 which houses the first key operated lock 14 and the locking means 13. Selectively operable locking means 13 is provided to enable the turn knob 9 to be rendered inoperable. Such locking means can be of any suitable form, and one particular form will be hereinafter described. It is preferred that the locking means includes a key operated lock 14 and in a typical arrangement that lock includes a body or cylinder 15 and a barrel 16 rotatably mounted in the cylinder 15. Tumblers (not shown), such as pin tumblers, may interact between the cylinder 15 and the barrel 16 in a known manner so as to prevent relative rotation of the barrel 16 unless a correctly cut key is inserted into a key way (shown in figure 1) of the barrel 16. The cylinder 15 may be mounted within the turn knob 9 as hereinafter described so as to be held against movement relative to the knob 9, and the barrel 16 may be connected to other parts of the locking means 13 in any appropriate fashion.

In a typical arrangement the two locks 10 and 14 are able to be operated by the same key, but that is not essential.

The locking means 13 of the construction shown in Figure 2 includes the lock 14 and two detents 18 which are cooperable with the turn knob 9 and which are controlled in a manner hereinafter explained. Although two detents 18 are shown, it will be appreciated that a single detent 18 could be used. In the particular arrangement shown, each of the detents 18 is of elongate form and is slidably mounted on the turn knob 9 so as to be movable in the direction of the longitudinal axis of the detent 18 and so as to be engageable with a fixed part of the casing 5, or a member attached to casing 5. The detents 18 are located on opposite sides of the rotational axis of the turn knob 9 and are movable in opposite directions radial of that axis.

When the locking means 13 is inactive, each of the detents 18 is fully contained in a cylindrical cavity C of the casing, which is shown in Figures 3 and 5. An inner hub 20 of the turn knob 9 which carries the detents 18 is located within the cavity C, and when the detents 18 are in the position shown by Figure 3 they do not hinder rotation of the knob 9. When the locking means 13 is

active, the detents 18 are moved radially outwards beyond the periphery of the hub 20 as shown by Figure 5 so as to engage the casing 5 or a member attached thereto. In the arrangement shown each detent 18 is slidably mounted in a respective one of two locking recesses 21 formed in the knob hub 20 and thereby coact with the knob 9 to prevent rotation of the knob 9 when the detents 18 are positioned as shown in Figure 5 to engage the casing 5 or a member attached thereto. It will be appreciated that other arrangements and other forms of locking means could be adopted.

In the particular arrangement shown, movement of the detents 18 is controlled by a drive means which in the illustration is a rotatable cam 22. The example cam 22 as shown includes two recesses 23 formed in the peripheral surface 24 and arranged in diametrically opposed relationship. As shown by Figure 3, each of the recesses 23 receives an inner end portion of a respective one of the detents 18 when the locking means 13 is inactive. As shown by Figure 5, the inner end of each detent 18 engages against the peripheral surface 24 when the locking means 13 is active. A sloping ramp surface 25 extends between the base of each recess 23 and the surface 24 so as to progressively move the detents 18 radially outwards when the cam 22 is rotated relative to the hub 9 in one particular direction as shown by the arrow "A" in Figure 5.

Any suitable connection may be provided between the cam 22 and the turn knob 9 so as to cause the cam 22 to rotate in an appropriate manner in response to rotation of the barrel relative to the turn knob. In the particular arrangement shown the cam 22 is located within a cylindrical cavity 26 (Figure 2) of the turn knob 9 so as to be capable of limited rotation relative to the turn knob 9. An arm 27 projects laterally from an outer surface of the cam 22 and is positioned between two stops 28 and 29 formed within the turn knob 9. Relative rotation between the cam 22 and the turn knob 9 is limited by the spacing between the stops 28 and 29 and the thickness of the arm 27. It is preferred as shown that a spring 30 acts between the turn knob 9 and the cam arm 27 so as to normally urge the arm 27 against the stop 28 (Figures 3, 7 and 9), but other arrangements could be adopted for that purpose.

It will be observed from Figure 3 that the detents 18 are inactive when the relative rotational positions of the cam 22 and the turn knob 9 are such that the arm 27 engages the stop 28, which will be hereinafter referred to as the first position of rotation of the cam 22. When the cam 22 is rotated relative to the turn knob 9 so as to engage against or locate adjacent the stop 29 (the second position of rotation) the detents 18 are cammed into the active position as shown by Figure 5. The spring 30 tends to move the cam 22 back to the Figure 3 position and releasable retainer means is provided to prevent that movement.

Referring again to figure 2, the latch assembly according to the invention includes an indicator means 73 which provides a visual indicator visible from the inner side of the assembly 1 that the locking means 13 is in the active condition. The indicator means 73 illustrated is a preferred embodiment which includes a driven member 74 which engages the cam 22. One end of the illustrated driven member 74 includes a plurality of projections 75 which engage with projections 76 on the cam 22. The other end of the driven member 74 includes an active indicator surface 71 which in use is located in a cup 77. A lower end of the cup 77 is adapted to provide a window 70 through which the active indicator surface 71 is visible when the locking means 13 is active.

Referring still to figure 2, the indicator means illustrated also includes a inactive indicator member 78 which is separate from the driven member 74. The inactive indicator member 79 may be formed integrally with or provided by the driven member 74 and the illustrated embodiment is merely preferred. The inactive indicator member 79 includes an inactive indicator surface 79 which in use is positionable adjacent the active indicator surface 71 in the cup 77. When in use either the inactive indicator surface 78 or the active indicator surface 71 is visible through the window 70 to indicate the locking means is inactive or active respectively.

Referring now to figure 3, the illustration shows the locking means 13 is in an inactive condition. The driven member 74 is positioned such that the inactive indicator surface 78 is visible through the window 70 as shown in figure

4. Rotation of the cam 22 causes the driven member 74 to rotate through the driving engagement between the cam 22 and the driven member 74 as shown in figure 5. This rotation of the driven member 74 aligns the active indicator surface 71 with the window 70 to indicate the locking means 13 is in the active condition as shown in figure 6.

In the particular arrangement shown, for example in figure 3, the cam retainer means includes a member which can be moved into and out of cooperative engagement with the cam 22. Preferably that member is in the form of a lever 31 which is mounted for rocking or pivotal movement between cam retaining and cam release positions respectively. The cam retaining position is shown by Figures 5 and 6 and the cam release position is shown by Figures 7 and 8. It is further preferred that the lever 31 is connected to the lock barrel 16 for rotation with that barrel.

In the particular arrangement shown, the lever 31 is carried by a cylindrical turret 32 which is connected to the lock barrel 16 for rotation with that barrel. The lever 31 is nested within a transverse slot 33 of the turret 32 so as to be movable between the cam retaining position as shown in Figures 5 and 6, and the cam release position as shown in Figures 7 and 8. For the purpose of that movement, which is essentially pivotal movement, each of two lateral wings 34 of the lever 31 locate within a respective recess 35 of the turret 32. The lever 31 is held in assembly with the turret 32 by an overlying plate 36, and a projection 37 at the undersurface of the plate 36 bears against the upper surface of the lever 31 to facilitate pivotal movement of the lever 31. Other types of pivotal mounting could be adopted. A downturned lug 38 at one end of the lever 31 cooperates with the cam 22 as described below.

When the lever 31 is in the cam retaining position (Figures 5 and 6) the lug 38 engages against a side 39 of a projection 40 which is upstanding from an upper surface of the cam 22. Biasing means preferably urges the lever 31 into a pivotal position at which engagement between the lug 38 and the projection 40 can occur, and in the arrangement shown that biasing means 20 includes a spring 41 which acts between the turret 32 and the lever 31.

Referring again to figure 2, the indicator means illustrated includes a biasing means 80 for biasing the driven member 74 towards displaying the inactive indicator surface 78. The biasing means 80 illustrated is in the form of a coil torsion spring, one end of which is engaged in a slot 81 in the driven member 74, the other end of which acts against an inner surface of the hub 20. When the cam is rotated in the direction of arrow "A" the biasing means stores the energy. When the lever 31 is moved to disengage from the cam projection 40, as shown in figures 7 and 8, compression spring 30 and biasing means 80 will bias the cam 22 and driven member 74 respectively to rotate to the lock inactive condition. Once in this position the inactive indicator surface 78 will be visible through the window 70 as shown in figure 8.

In the situation shown by Figure 5 the turn knob 9 is held against rotation by the detents 18 engaging with the casing 5 or a member secured thereto. The cam 22 is attached to the turn knob 9 as previously described and consequently cannot move relative to the turn knob in the direction of 25 arrow "B". Also, the lever 31 is unable to rotate about the axis of the cam 22 because of its connection with the lock barrel 16 which cannot rotate relative to the cylinder 15 until released by an appropriate key.

Lock release means is provided to enable the lever 31 to be moved out of blocking engagement with the cam projection 40. In the particular arrangement shown, the lock release means is arranged to have direct influence on the cam retainer means, and it is preferred that such influence is achieved through a rotatable camming member 42 which forms part of the release means and is connected to the outside lock 10 so as to rotate in response to rotation of the lock barrel 12. As shown by Figure 2, that connection may include a drive bar 43 of non-circular cross-sectional shape which engages at one end within a slot 44 in an end of the barrel 10, and engages at its other end in a rectangular aperture 45 formed through the camming member 42.

The camming member 42 is arranged to overlie the lever 31 at the side of that lever remote from the cam 22. A camming lug 46 provided on the

member 42 has a sloping cam face 47 which is adapted to engage against an upstanding portion 48 of the lever 31 which projects above the plate 36 when the lever 31 is in the cam retaining position. Rotation of the member 42 caused through operation of the lock 10, results in coaction between the cam face 47 and the lever portion 48 such that the lever 31 is progressively forced downwards against the action of the spring 41 towards the position shown in Figure 8.

Having now described the principle components of the embodiment of the invention shown in the drawings, the operation of that embodiment is as follows.

When the lock 14 is in a released condition the cam 22, the detents 18 and the inactive indicator surface 78 will be positioned as shown by Figure 3. The turn knob 9 is able to be rotated as required to operate the latch bolt 3. In that regard, the knob 9 may coact with the latch bolt mechanism through a drive plate 49 in a known manner.

If it is desired to lock the turn knob 9 against rotation the lock barrel 16 is turned in the direction of arrow "A" (Figures 3 and 5) by means of an appropriate key 50. The lock barrel 16 is turned through approximately 360 degrees from the position shown in Figure 3 to the position shown in Figure 5. During a final part of that movement the lever lug 38 engages against the side 39 of the cam projection 40 and thereby pushes the cam 22 against the influence of the spring 30 so that the cam 22 is moved from the first position of rotation shown by Figure 3 to the second position of rotation shown by Figure 5.

As a consequence the detents 18 are cammed out of the recesses 23 to lock the turn knob 9 against rotation. Furthermore rotation of the cam member 22 causes rotation of the driven member 74to display the active indicator surface 71 in the window 70.

Rotation of the cam 22 relative to the turn knob 9 in the direction of arrow "B" (Figure 5) is prevented by coaction between the lever lug 38 and the cam

projection 40. In that regard, the lock barrel 16 (Figure 6) is held against rotation in the direction of arrow "B" by the action of the lock tumblers (assuming there is no key in the lock), and the lever 31 is unable to rotate about the barrel axis independent of the barrel 16.

It will be apparent that the restraining influence of the lever 31 does not prevent a key 50 being used to turn the lock barrel 16 in the direction of arrow "B" so as to return the barrel 16 from the Figure 5 position to the Figure 3 position. On the other hand, operation of the outer lock 10 will remove the restraining influence of the lever 31 in the following manner.

Rotation of the lock barrel 12 causes corresponding rotation of the camming member 42 through the connection described by reference to Figure 2. As the camming member 42 rotates with the lock barrel 12 the cam face 47 engages the lever portion 48 and thereby progressively pushes the lever 31 down against the influence of the spring 41. As a consequence the lever 31 is eventually caused to adopt the position shown by Figure 8 at which the lever lug 38 no longer blocks movement of the cam projection 40. The cam 22 is thereby free to rotate relative to the turn knob 9 in the direction of arrow "B" under the influence of the spring 30. Rotation of the cam 22 causes rotation of the driven member 74 to display the inactive indicator surface 78 in the window 70. The compression spring 30 could provide the biasing force alone, however it is preferred that it be assisted by the biasing means 80. The projection 40 is thereby able to adopt a position relative to the lever 31 as shown by Figure 7. Furthermore, the aforementioned movement of the cam 22 places the cam recesses 23 in a position such that the detents 18 can move inwards to adopt the inactive condition. That inward movement of the detents 18 might occur automatically, or it might occur as a consequence of the rotation of the turn knob 9. In that regard, the outer end of each detent may be rounded or otherwise shaped so that turning movement of the knob 9 relative to the casing 5 imposes a force on each detent 18 which has a component acting in the longitudinal direction of the detent 18.

When the cam 22 has adopted the Figure 7 position it will retain that position under the influence of the spring 30 unless forced out of that position by operation of the lock 14. Consequently, the turn knob locking means 13 is automatically deactivated when the lock 10 is operated and it remains deactivated until deliberately returned to the active condition by operation of the lock 14.

As stated previously, the driven member 74 hereinbefore described is a preferred embodiment of the indicator means 73 and as such alternative indicator means 73 are possible. Figure 9 illustrates a further preferred embodiment of the indicator means 73 whereby a periferal ledge 82 of the cylindrical cavity of the turn knob 9 which accommodates the cam 22 is adapted to include a window 70. In this embodiment the underside of the of cam includes at least the active indicator surface 71 (not shown), which when visible through the window 70 in the ledge 82 indicates the locking means 13 is in the active condition, as shown in figure 10. Figure 11 shows a further alternate form of the indicator means 73. In the preferred embodiment illustrated in figure 11 the window 70 is located in the detent slide locking means 21 the turn knob 9. The underside of the detent 18 includes at least the active indicator surface (not shown) which is visible through the window 70 when the locking means 13 is in the active condition as shown in figure 12. In either preferred embodiment shown in figures 9 and 10, or 11 and 12 the cam and the detent will move during the operation of the locking means 13. Accordingly the window 70 is located relative to the cam 22 or detent 18 to display the active indicator surface 71 when the locking means is active. The cam and the detent may also include the inactive indicator surface.

It is preferred that either the inactive indicator surface or active indicator surface include fluorescent material to facilitate indicating the condition of the locking means in darkness.

It will be appreciated from the foregoing that the invention provides a relatively simple means for conveying the condition of the locking means to the user without requiring the user to test the operability of the turn knob.

Various modifications, alterations and or additions may be made to the invention as hereinbefore described without departing from the spirit or ambit of the invention.

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